Scalable nanostructuring on polymer by a SiC stamp

optical and wetting effects

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Scalable nanostructuring on polymer by a SiC stamp: optical and wetting effects

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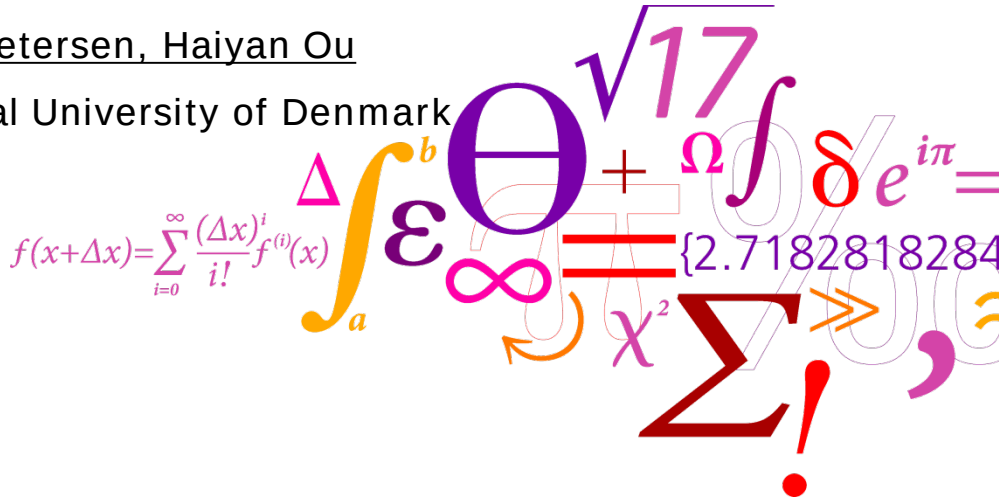

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Outline

Motivation

Fabrication

- Wafer-Scale nanostructuring of SiC stamp
- Replication of nanostructures on a polymer surface

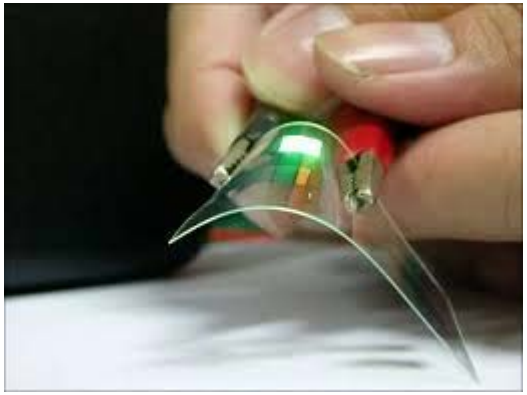
Characterization

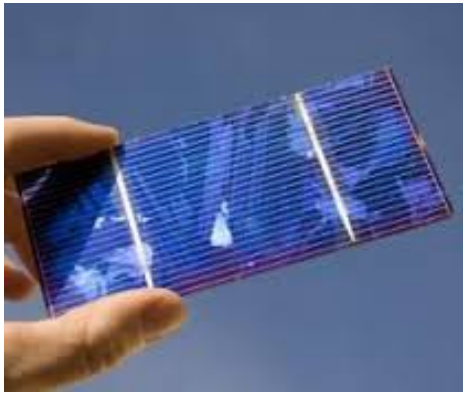
-Optical effects

-Wetting properties

Conclusions

Motivation





Push performance of devices towards their optimum limits by controlable fabrication of interfaces at the nanoscopic level.

Polymer materials gain interest both as semiconductors and conductors due to their low cost.

Prerequisites

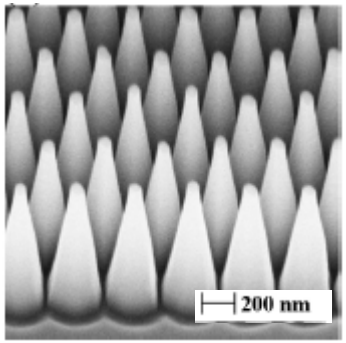
Fabrication of nanostructures that result in macroscale effects with reproducibility !

and….nanopattern definition must be:

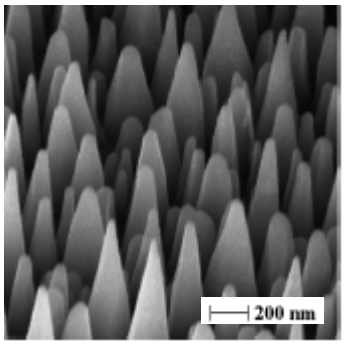
- Rapid
- Low-cost
- Applicable on wafer scale-high throughput

SiC nanostructuring: summary table

Type of structures	Method	Average Reflectance (%)	Luminecence enhancement (from 10 to 80 degrees)
Periodic	E-beam	1,01	104%
Semi-periodic	Self-assembly	1,62	67%



Periodic



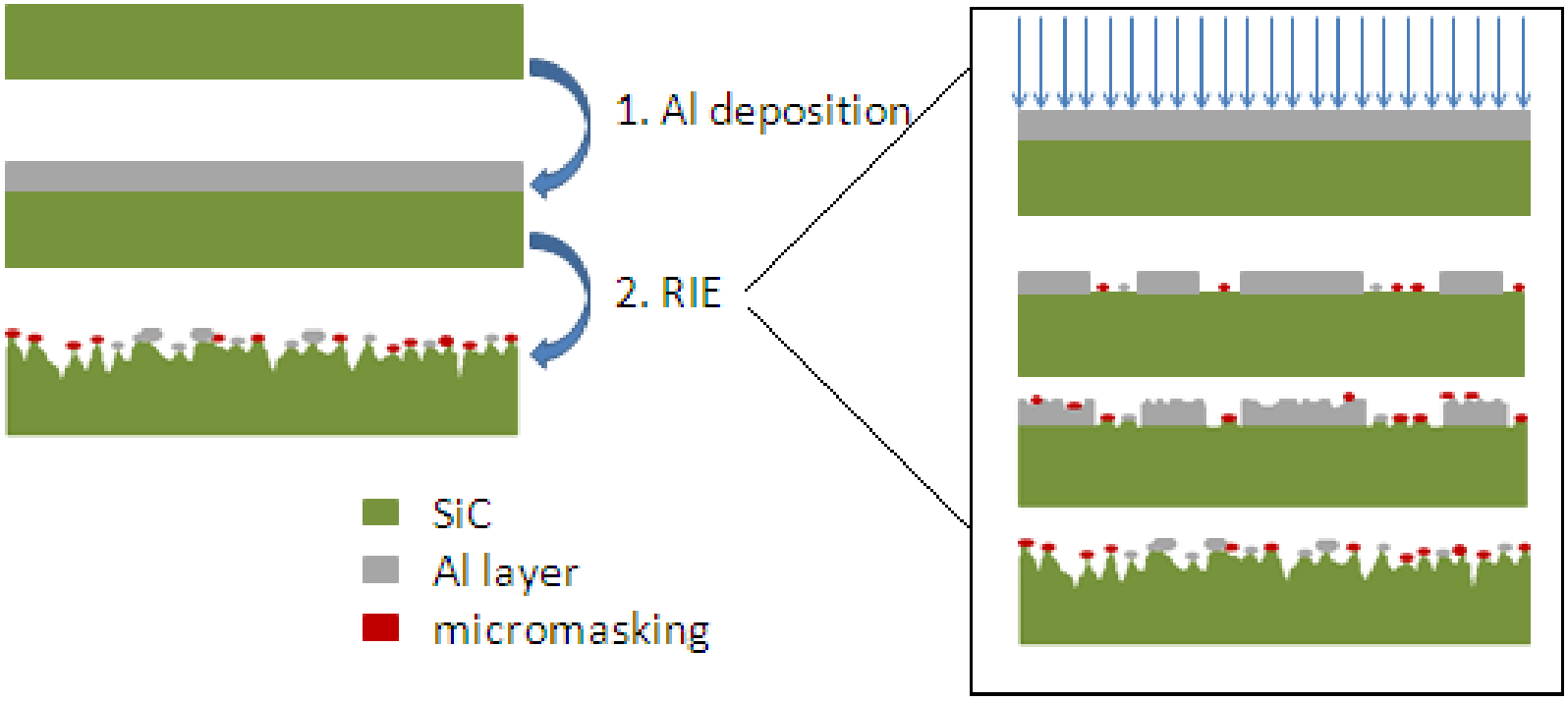
Semi-periodic

*Reference:

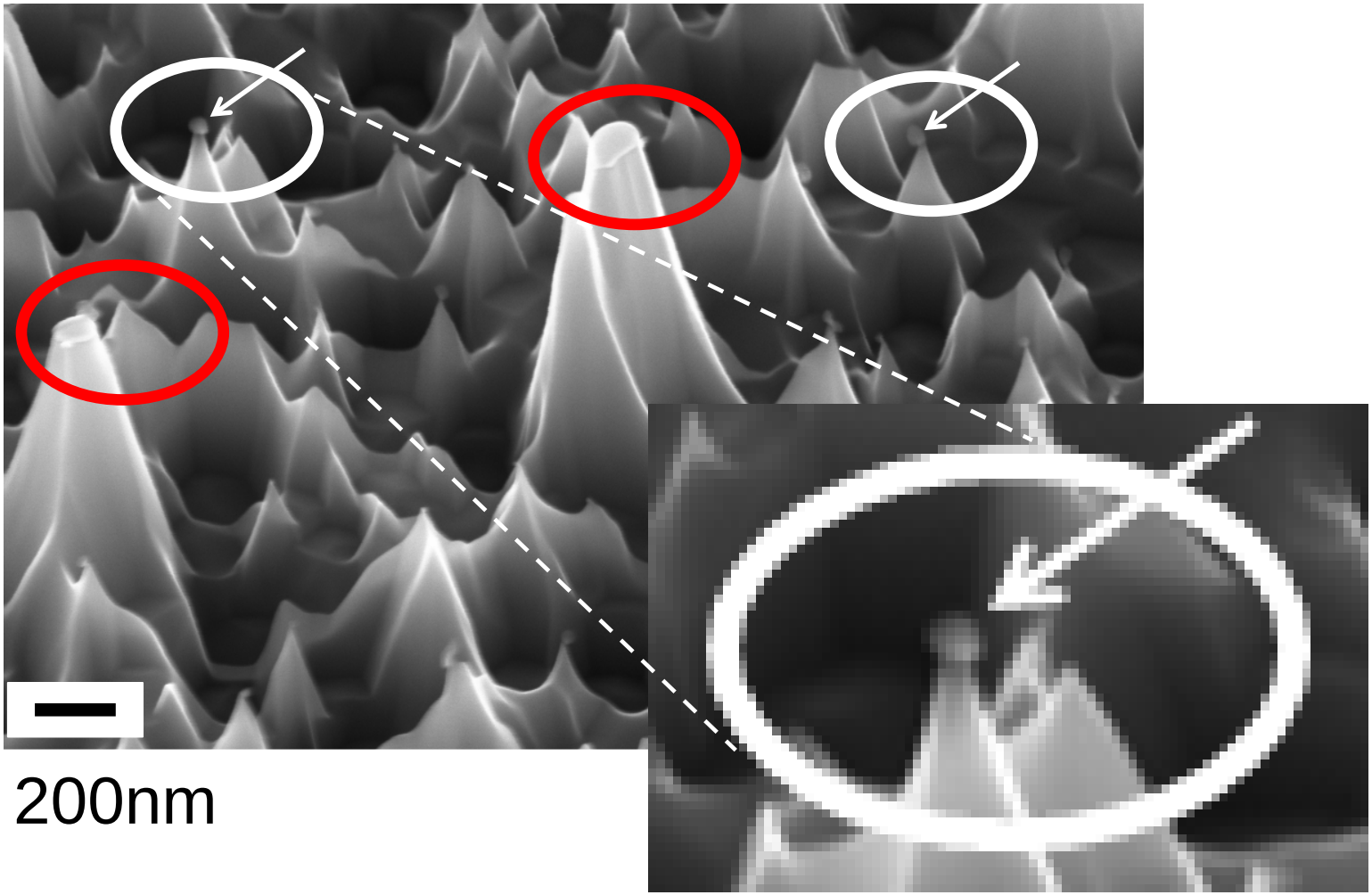
Y. Ou, et al., Optics Express 20, 7, 2012.

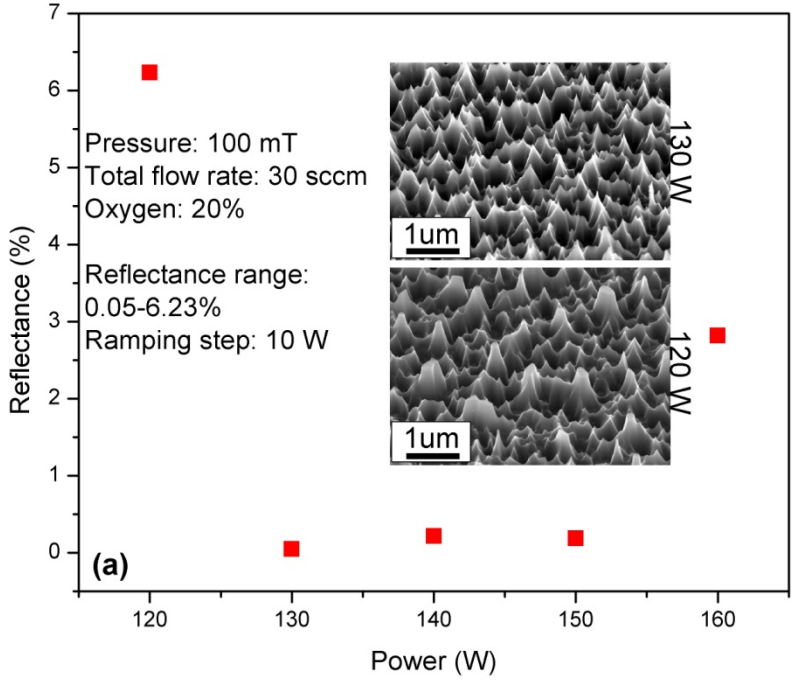
Y. Ou, et al., *Opt. Lett.* 37, 18, 2012.

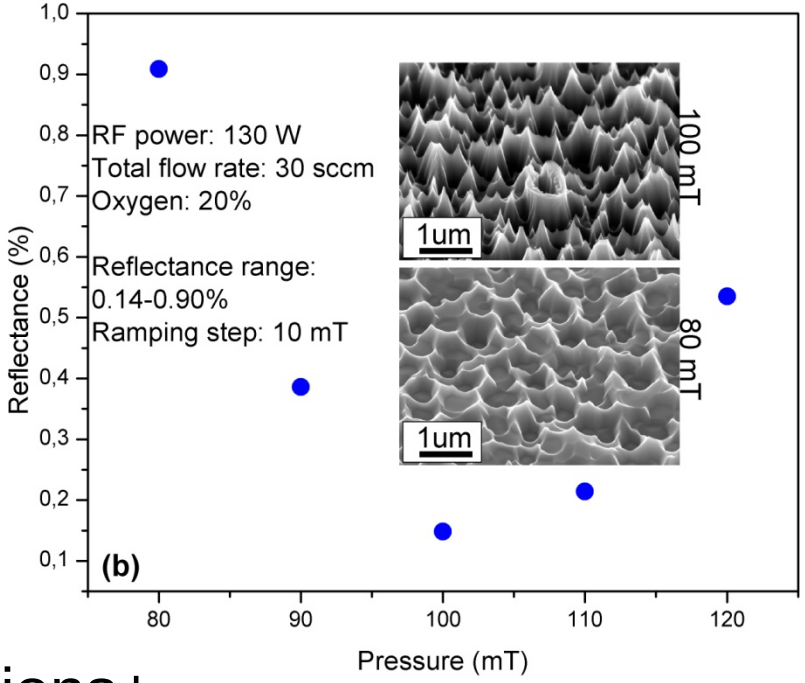
A cost effective method for SiC aperiodic nanostructuring



Combinatory masking



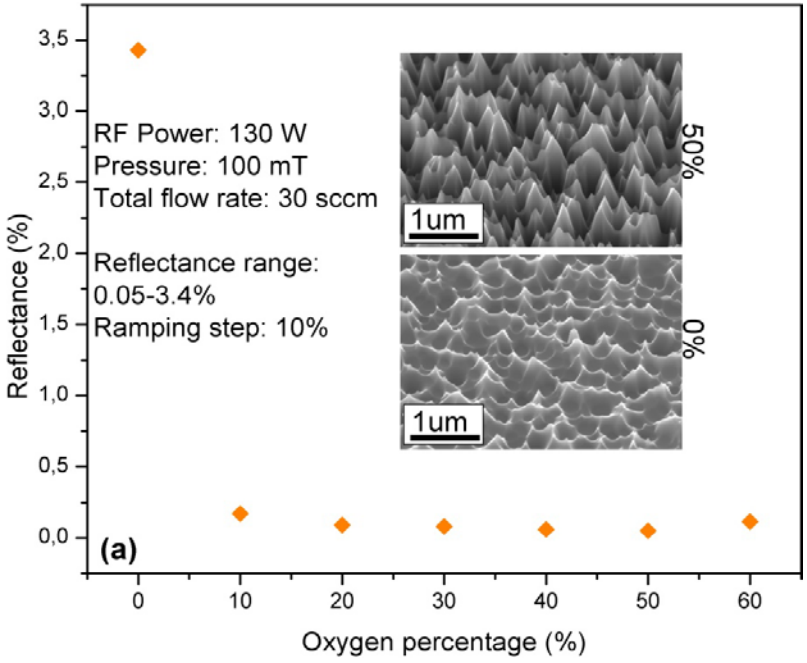


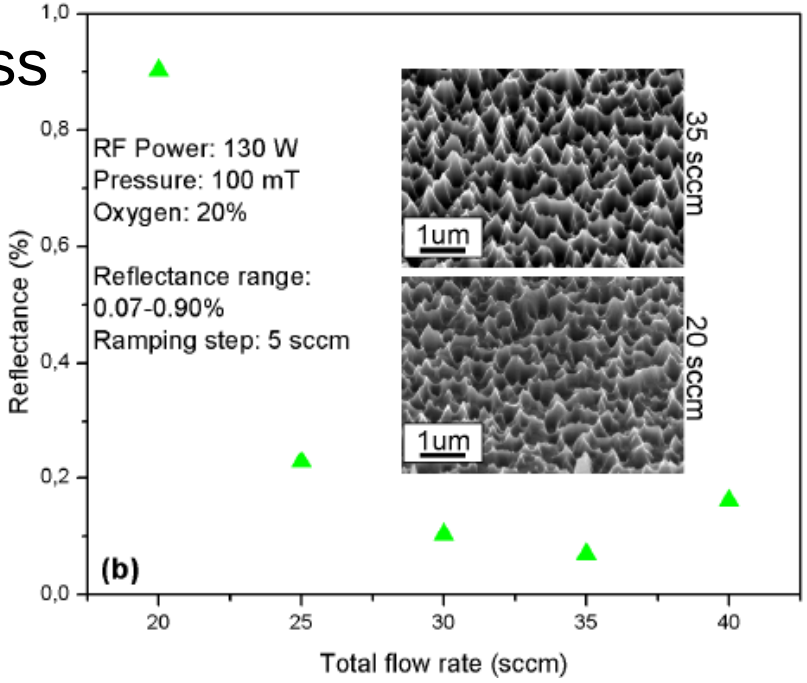


Ramping:

RIE conditions+

Al thickness

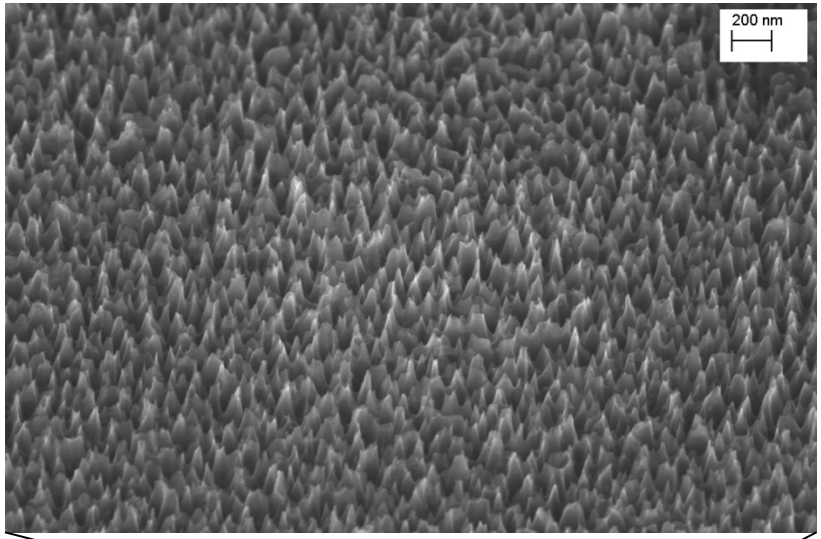


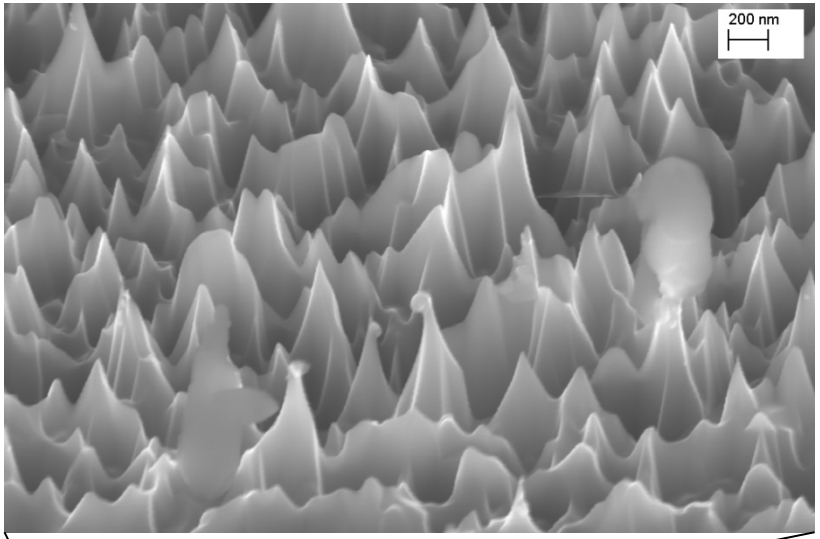


*Reference:

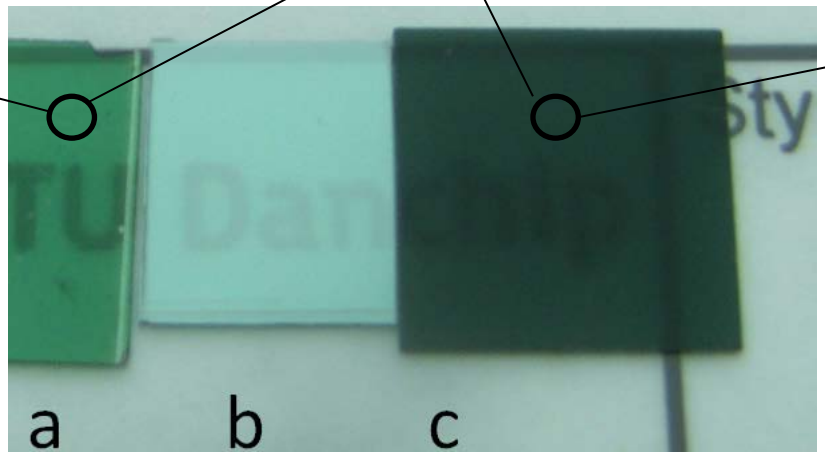
A. Argyraki et al., Optical Materials Express 8(3) 2013.

Fabrication of different nanotopographies

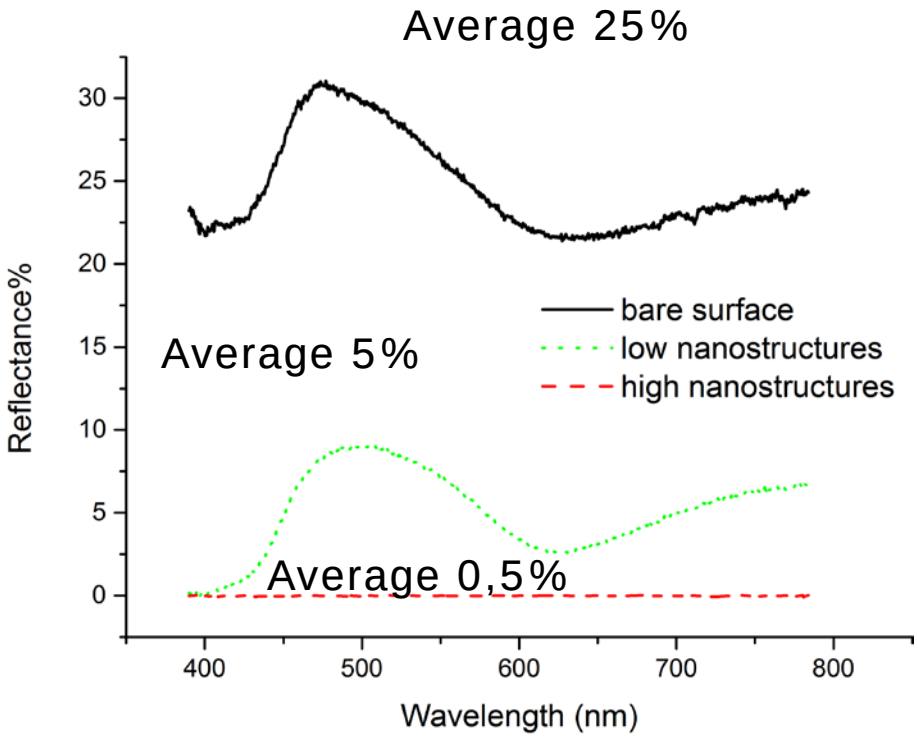


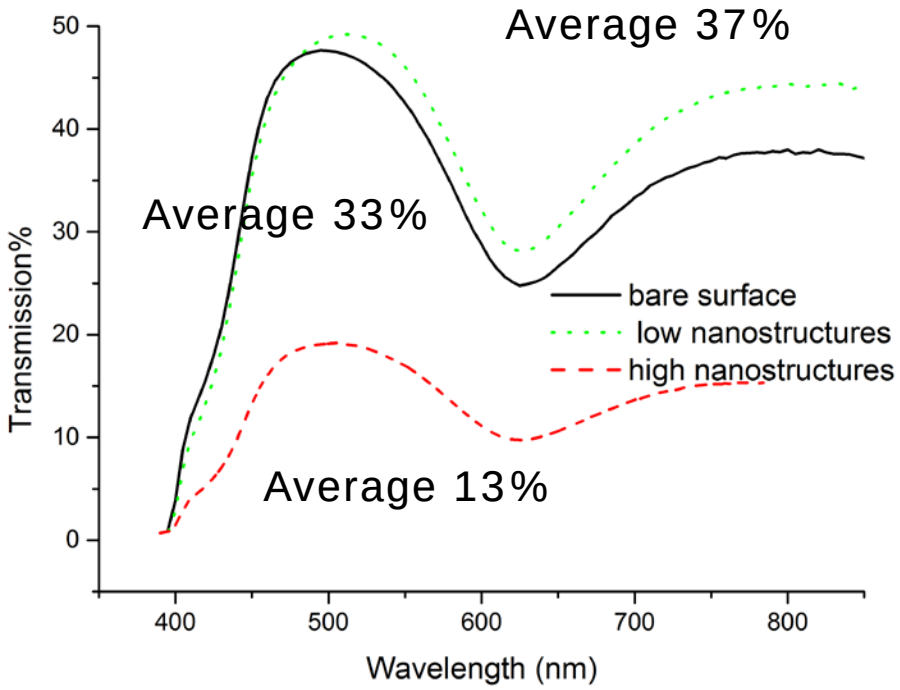


Color texture changes due to nanostructuring

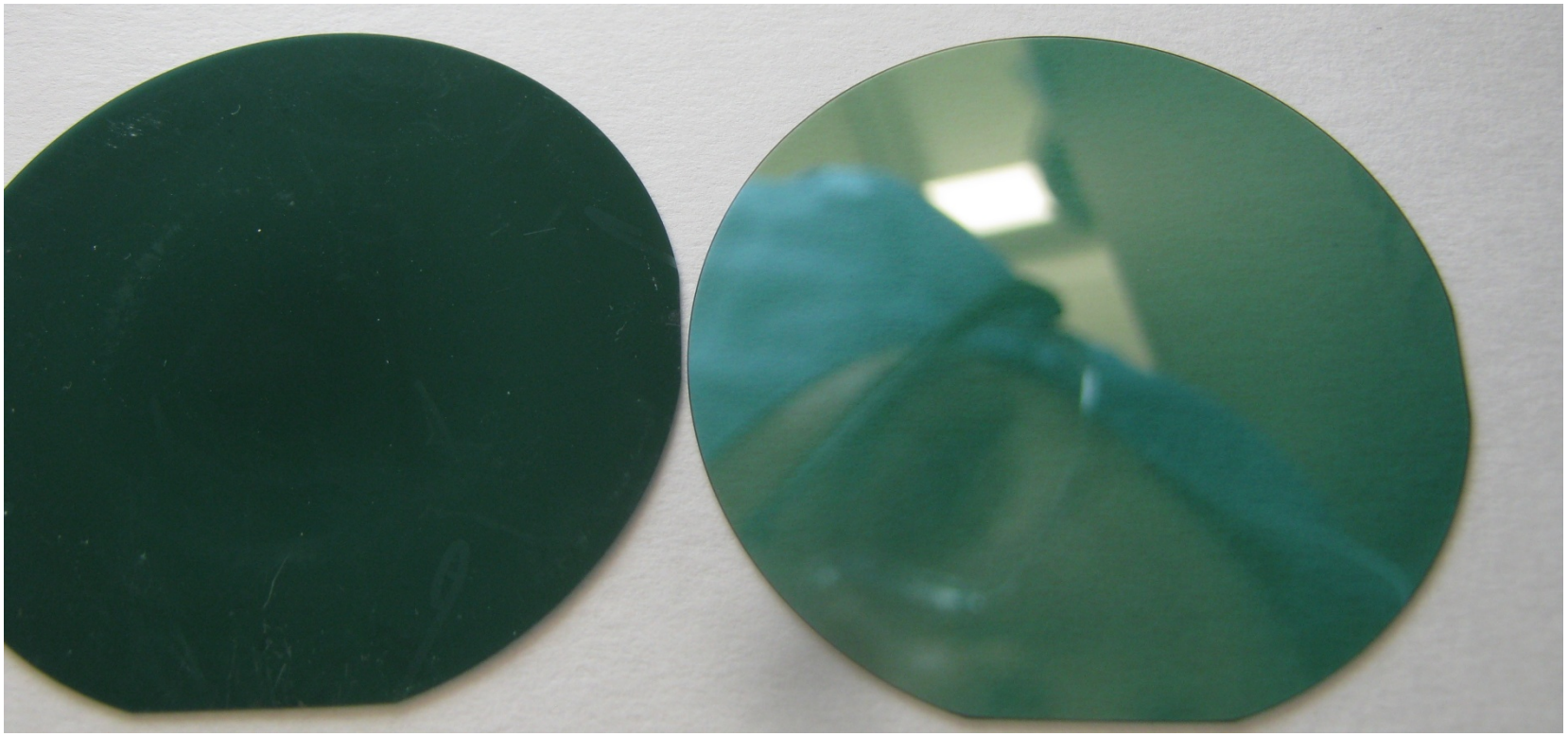


Optical properties: Reflection, Transmission



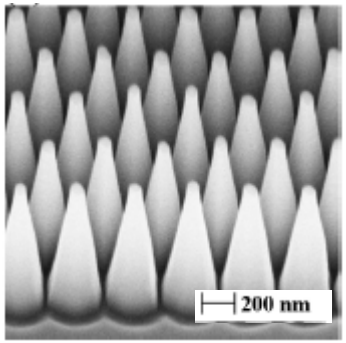


Scalability

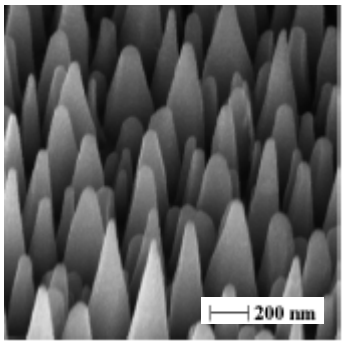


Summary table

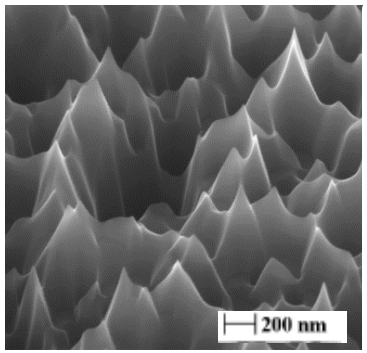
Type of structures	Method	Average Reflectance (%)	Luminecence enhancement (from 10 to 80 degrees)
Periodic	E-beam	1,01	104%
Semi-periodic	Self-assembly*	1,62	67%
Stochastic	Combinatory masking	0,50	165%



Periodic



Semi-periodic

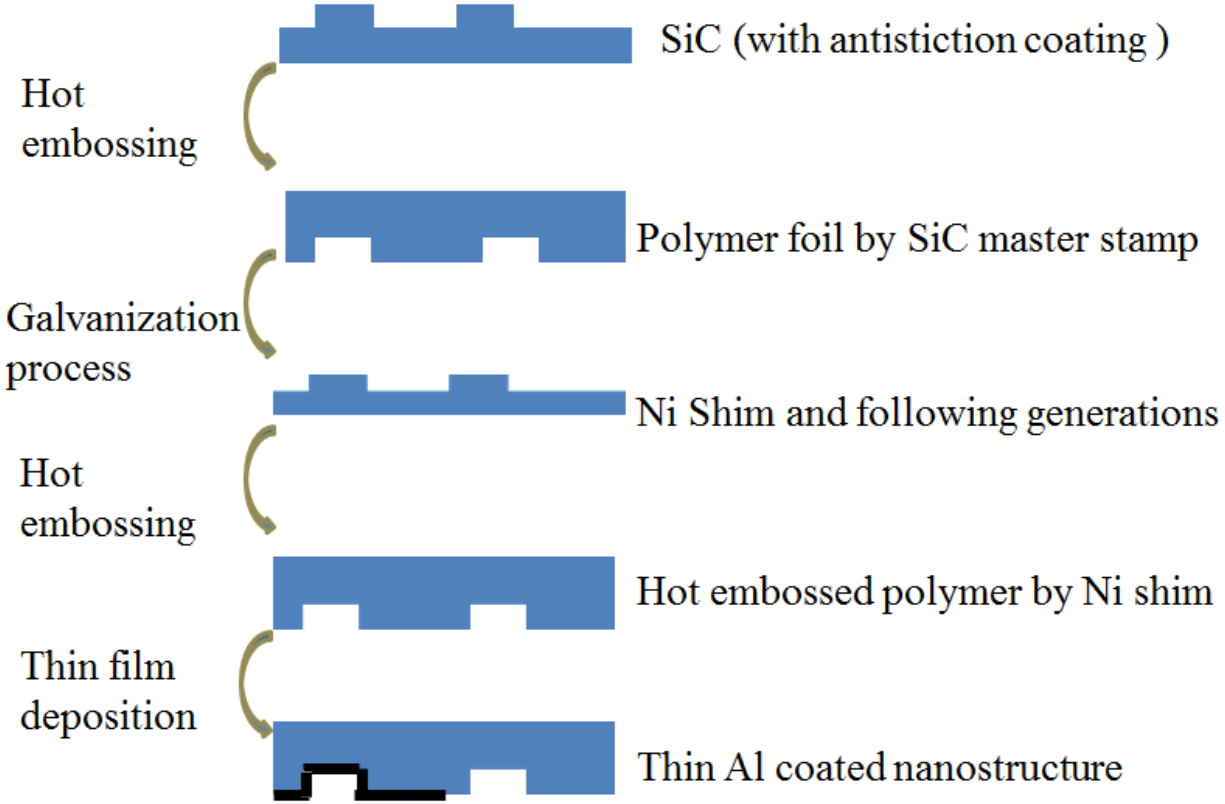


Stochastic

*Reference:

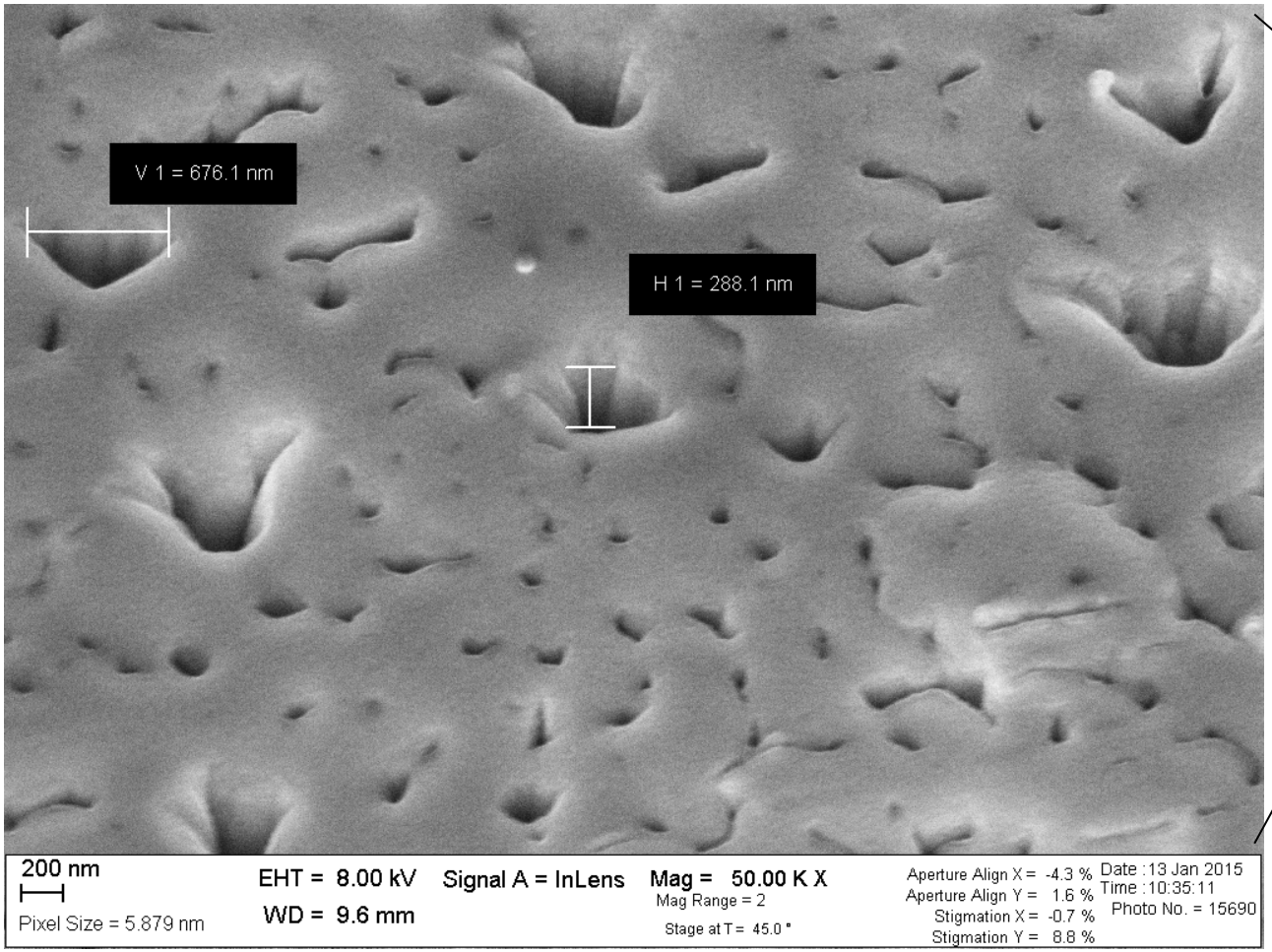
Ou, H., Advances in wide bandgap SiC for optoelectronics, The European Physical Journal B

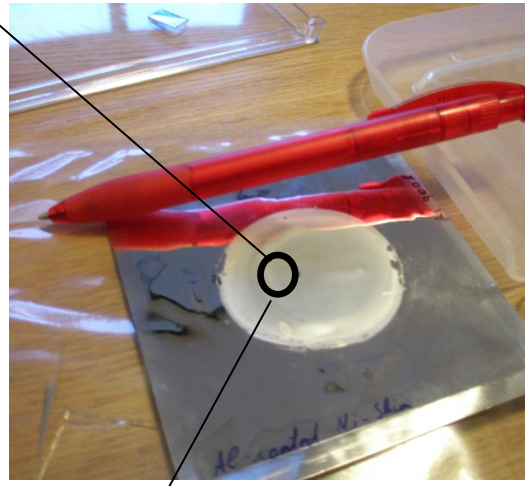
Replication of nanostructures on polymer



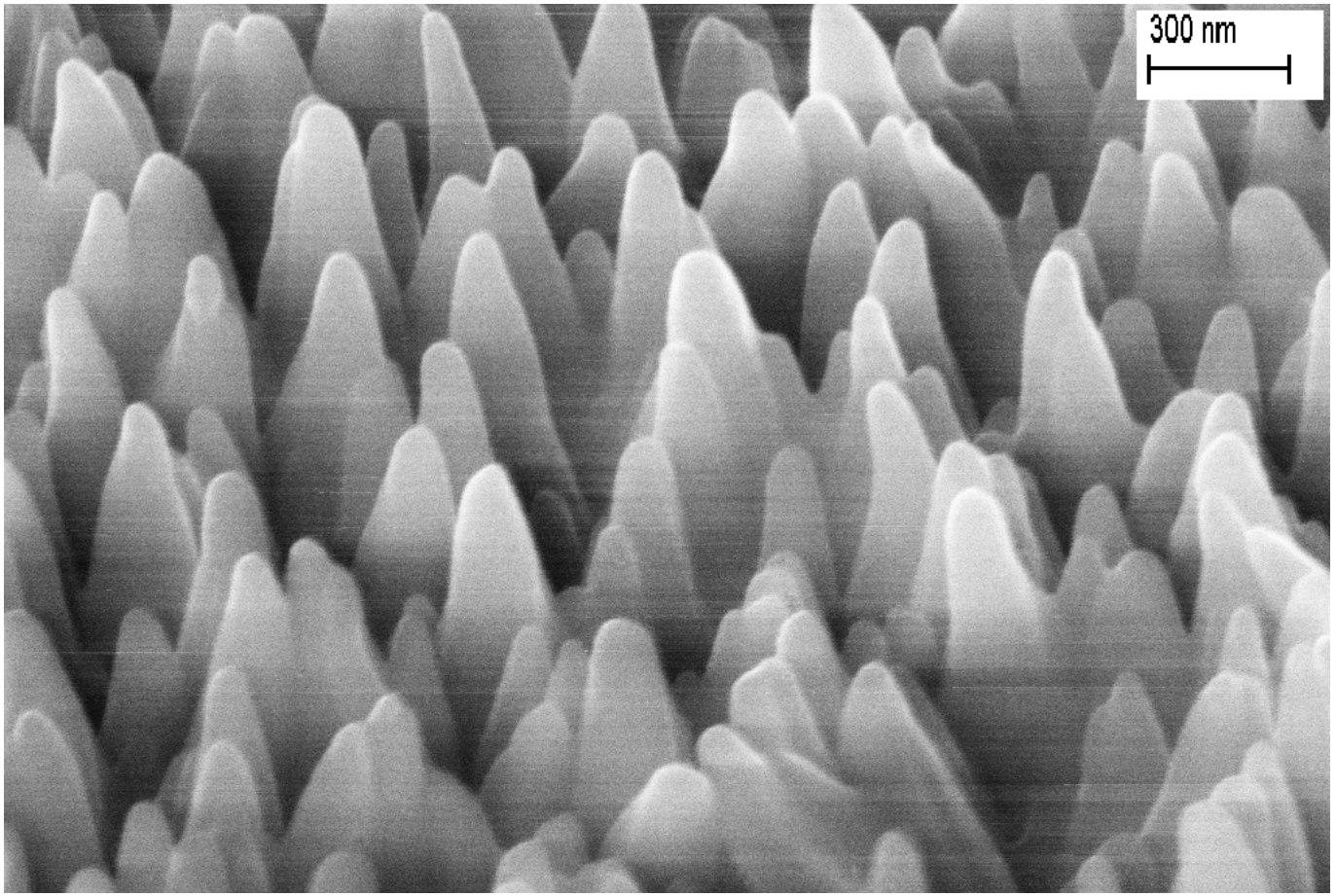
Process flow

Ni shim: generation

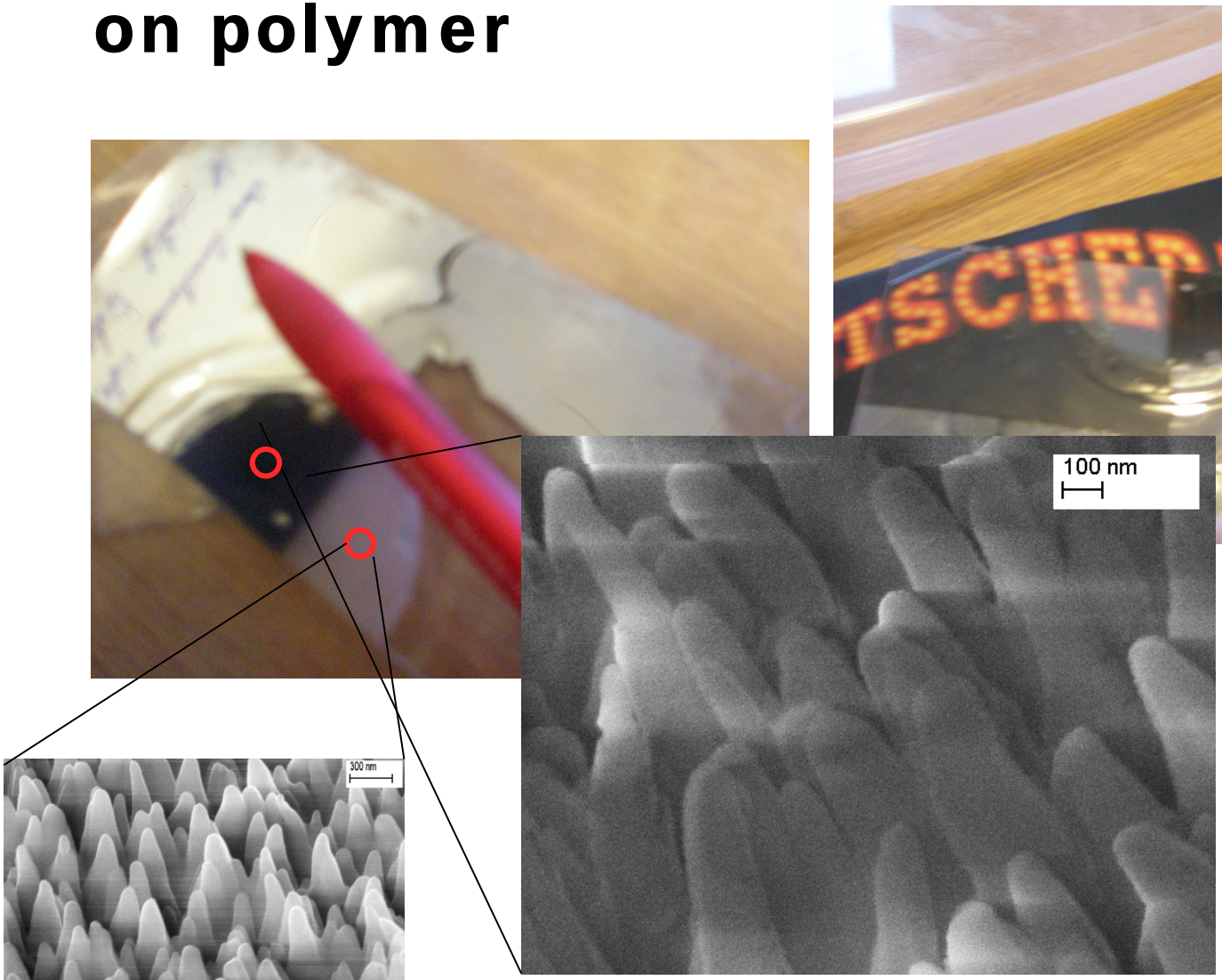




Nanostructured polymer surface

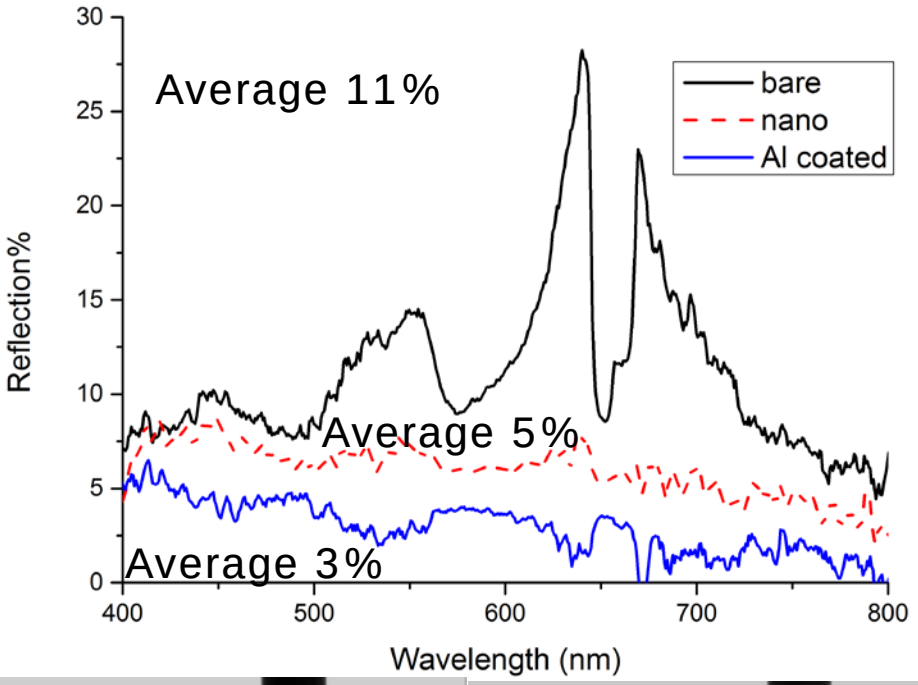


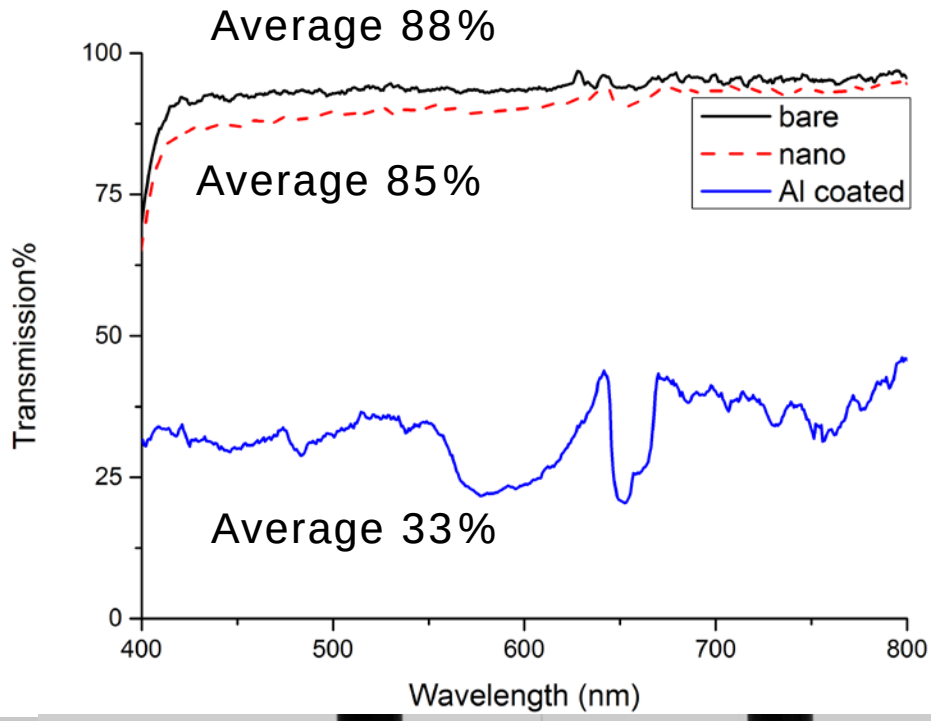
Color textures after nanostructuring on polymer

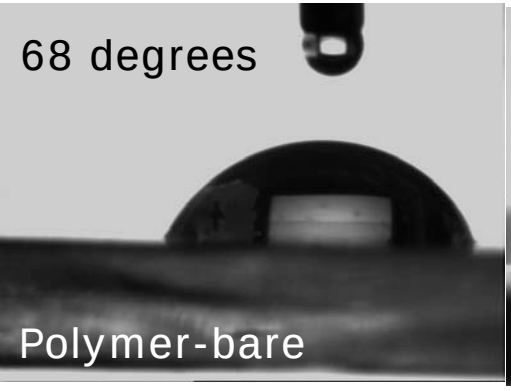


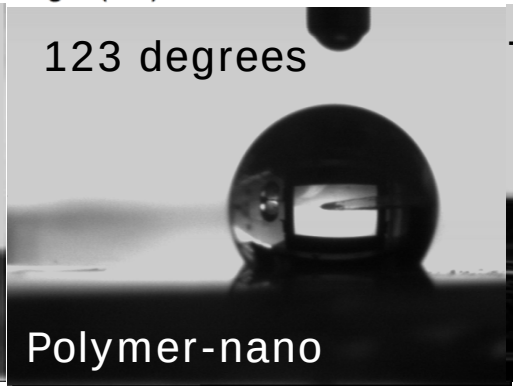
A thin Al layer (~40nm)

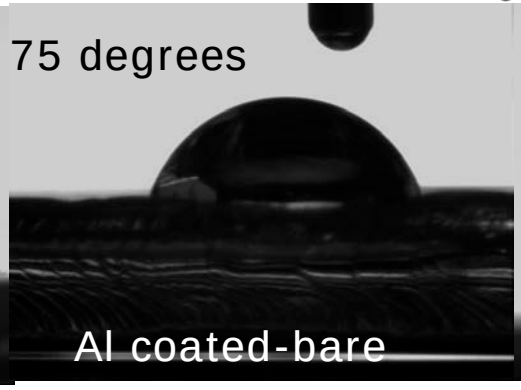
Optical and wetting properties after nanostructuring on polymer

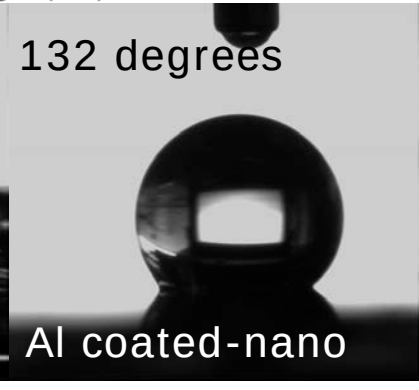










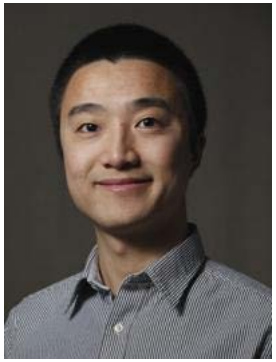


Conclusions

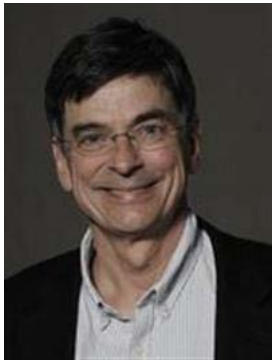
- Demonstrated 2 inch wafer nanostructuring on polymer by a SiC stamp
- Color texture and transmitance of SiC surface was controled by nanotopography applied
- Color texture and reflectance of polymer surface was significantly altered by nanostructuring and additional deposition of a thin Al layer
- Wetting properties of surfaces shifted after nanostructuring from hydrophilic to hydrophobic

Acknowledgment

Weifang Lu



Yiyu Ou



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Haiyan Ou

Thank you for your attention

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